

In the Claims

Claim 1, line 3, delete "near."

Claim 32, line 3, for "composite" substitute -- composition --.

R E M A R K S

A. Summary of the Present Invention

The present invention broadly concerns a ceramic-like material which is superconductive with a superconductive/resistive transition temperature of about 26°K or greater. Preferred examples of such superconductive ceramic-like materials have a layer-like crystalline structure and an elemental composition of RE-AE-TM-O, where RE is a rare earth or rare earth-like element, AE is an alkaline earth element, TM is a transition metal element, and O is oxygen.

B. Summary of the Outstanding Office Action

In the Office Action of 8 August 1990, restriction was required under 35 U.S.C. Section 121 to one of the following three groups of claims:

I. Claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65

through 68 inclusive, assertedly drawn to a superconducting composition, classified in Class 423, Subclass 604;

II. Claims 24 through 26 inclusive, 73 through 76 inclusive, 82, 83 and 86 through 90 inclusive, assertedly drawn to a method of making, classified in Class 505, Subclass 725; and

III. Claims 12 through 23 inclusive, 36 through 39 inclusive, 55 through 59 inclusive, 64, 69 through 72 inclusive, 77 through 81 inclusive, 84, 85, and 91 through 95 inclusive, assertedly drawn to a superconductor apparatus, classified in Class 505, Subclass 825.

It was asserted In the Office Action that the inventions of the claims of Group I and Group II were related as process of making and product made. It was asserted that such inventions would be distinct if (1) the processes claimed could be used to make other and materially different products, or (2) if the product as claimed could be made by another and materially different process. Section 806.05(f) of the Manual of Patent Examining Procedure ("the MPEP") was cited. It was asserted that in the instant case the product as claimed could be made by a process such as sputtering, which was characterized as materially different.

The inventions of the claims of Group I and Group III were asserted to be related as mutually exclusive species in an intermediate-final product relationship. It was asserted that distinctness would be established for claims in such a relationship if the intermediate product were useful to make other than the final product and the species were patentably distinct. Sections 806.04(b), third paragraph, and 806.04(h) of the MPEP were cited. It was asserted that, in the instant case, the intermediate product was deemed to be useful as a diamagnetic material used for bulk levitation. It was further asserted that the inventions were deemed patentably distinct since there was nothing in the present record to show the inventions to be obvious variants.

It was asserted in the Office Action that the inventions of the claims of Group II and Group III were related as process of making and product made. It was asserted that the inventions would be distinct if (1) the process claimed could be used to make another and materially different product, or (2) the product as claimed can be made by another and materially different process. Section 806.05(f) of the MPEP was cited. It was asserted that in the instant case the process could be used to make an assertedly materially different product such as a bulk diamagnetic material used for levitation.

It was asserted that because the inventions of Groups I, II, and III were distinct and had acquired a separate status in the art because of their assertedly recognized divergent subject matter, restriction for examination purposes was proper. It was stated that during a telephone conversation on 17 July 1990 with Mr. Jackson E. Stanland, an attorney for the applicants, a provisional election was made - with traverse - to prosecute the invention of Group I. It was indicated that affirmation of the provisional election must be made in the response to the outstanding Office Action. It was stated that claims 12 through 26 inclusive, 36 through 39 inclusive, 55 through 59 inclusive and 64 were withdrawn from further consideration as being drawn to a non-elected invention. The status of claims 69 through 95 inclusive was not indicated, although claims 69 through 95 had been assigned to the provisionally non-elected Groups II and III.

In the outstanding Office Action, the specification was objected to under 35 U.S.C. Section 112, first paragraph, as assertedly failing to provide an enabling disclosure commensurate with the scope of the claims. It was asserted that the subject specification was enabled only for compositions comprising $\text{Ba}_x\text{La}_{5-x}\text{Cu}_5\text{O}_y$. It was asserted that the art of high temperature superconductors characterized as greater than 30°K - was unpredictable one. It was asserted that small changes in composition could result in dramatic changes in or loss of superconducting properties. It was stated that the amount and

type of examples necessary to support broad claims increased as the predictability of the art decreased. In re Fisher, 166 USPQ 18, 24 and In re Angstadt and Griffin, 190 USPQ 214, 218 were cited in this connection. It was asserted that claims broad enough to cover a large number of compositions that did not exhibit the desired properties failed to satisfy the requirements of 35 U.S.C. Section 112. In re Cook, 169 USPQ 244,262 was cited. It was stated that reciting a desired result did not overcome such asserted failure. In re Corkill, 266 USPQ 1005, 1009 was cited.

It was questioned whether any material containing copper would exhibit superconductivity. It was questioned whether CuO was a superconductor. It was questioned whether any stoichiometric combination of a rare earth, an alkaline earth, and copper was a superconductor. It was questioned whether $Ce_{15}Mg_{0.05}Cu_{0.5}O_x$, $Ba_xLa_{5-x}Ni_5O_y$, and $Mg_{10}Y_{0.05}Fe_{0.05}O_1$ were superconductors.

It was asserted that, at the time the invention was made, the theoretical mechanism of superconductivity in these materials was not well understood. It was asserted that there was little factual or theoretical basis for extending the scope of the claims beyond the proportions and materials actually demonstrated to exhibit high temperature superconductivity. Quoting Brenner v. Manson, 383 US 519, 148 USPQ 689, it was stated that a "patent is

not a hunting license. It is not a reward for the search, but a reward for its successful conclusion."

Claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive were rejected under 35 U.S.C. Section 112, first paragraph, with a reference to the objection to the specification.

In the outstanding Office Action, claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive were rejected under 35 U.S.C. Section 112, second paragraph, with the assertion that the claims were indefinite for assertedly failing to particularly point out and distinctly claim the subject matter which the applicants regarded as their invention.

The term "near rare earth-like element" was questioned. What elements this term excluded and included was questioned.

It was asserted that the rejected claims were indefinite insofar as each assertedly failed to recite any stoichiometric limitation. How the metes and bounds of the invention would be determined was questioned.

With respect to a recitation of "doping" in claim 11, it was questioned how much dopant was required.

The phrase "enhances electron-phonon interactions to produce superconductivity" was questioned.

It was stated that there was no antecedent basis for the term "composite" recited in claim 32.

It was stated that claim 62 recited an "oxygen excess." What the "excess" was in relation to and how it would be determined was questioned.

It was asserted that the term "transition temperature" was indefinite. It was questioned whether "transition temperature" corresponded to a temperature at which resistivity was zero or a temperature at which resistivity began to drop.

It was asserted that the term "said superconductor being comprised of at least four elements" recited in claim 40 was vague and indefinite. It was asked how one selected the elements and would any combination of four elements in any stoichiometric ratio produce the desired result.

It was noted in the Office Action that the subject application had been filed in the United States on 22 May 1987. Declarations to establish an earlier conception and reduction to practice date submitted for the present application by and on behalf of the inventors were acknowledged. Although it was

asserted in the Office Action that the exact date to which the applicants were entitled was not fully clear, it was asserted that such date appeared to have been no earlier than about 17 October 1986, a date on which a sample and enabling disclosure was brought to the United States from Switzerland by Praveen Chaudhari. The Declaration of Praveen Chaudhari was cited in this connection. It was asserted further that such date would appear to be no later than 13 December 1986, a date on which samples were tested in the United States to show superconductivity. The Declaration of Richard L. Greene was cited. It was indicated that no prior art of record disclosed La-Ba-Cu-O as a superconducting system prior to 1 January 1987 and that there was no need to make a judgement as to what date represented a reduction to practice. A number of publications having a filing date later than 1 January 1987 were cited for purposes of record. It was acknowledged that one of the publications, a publication by Ganguly and Rao in volume 97 of the Proceedings of the Indian Academy of Sciences which purported to have a publication date in December 1986, had to have been published later than 1 January 1987, since the publication cited other references which were not published until 1987.

In the outstanding Office Action, claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive were rejected under 35 U.S.C. Section 102(b) as anticipated by, or, in the alternative, under 35 U.S.C. Section 103 as assertedly obvious

over, each of a publication by Shaplygin et al. in the Russian Journal of Inorganic Chemistry, volume 24, pages 820-824 (1979) ("the Shaplygin et al. publication"); a publication by Nguyen et al. in the Journal of Solid State Chemistry, volume 39, pages 120-127 (1981) ("the Nguyen et al. publication"); a publication by Michel et al. in the Materials Research Bulletin, volume 20, pages 667-671 (1985) ("the 1985 Michel et al. publication"); and a publication by Michel and Raveau in the Revue de Chimie Minerale, volume 21, pages 407-425 (1984) ("the 1984 Michel and Raveau publication"). It was asserted that the Shaplygin et al. publication disclosed the composition $\text{Ln}_{2-x}\text{M}_x\text{CuO}_4$, where M was Ca, Sr, Ba and Pb and Ln was La, Pr, Nd, Sm, Eu, and Gd. It was asserted that $\text{La}_{2-x}\text{Ca}_x\text{CuO}_4$ was disclosed on page 823. It was asserted that the Nguyen et al. publication disclosed the composition $\text{La}_{2-x}\text{Sr}_x\text{CuO}_{4-y}$. It was asserted that 1984 Michel and Raveau publication disclosed the composition $\text{La}_{2-x}\text{A}_{1+x}\text{Cu}_2\text{O}_4$, where A was Ca, Sr, Ba. It was further asserted that the 1985 Michel et al. publication disclosed the compositions $\text{BaLa}_4\text{Cu}_5\text{O}_{13.4}$ and $\text{La}_3\text{Ba}_3\text{Cu}_6\text{O}_{14+x}$. Although it was conceded in effect in the Office Action that none of the four publications disclosed superconductivity, it was asserted that each of the four publications appeared to fall within the scope of the subject matter as presently claimed. It was asserted that the burden of proof was upon the applicants to show that the subject matter differed from and was unobvious over that disclosed in the publications. In re Brown, 173 USPQ 685, 688; In re Best, 195 USPQ

430 and In re Marosi, 218 USPQ 289, 293 were cited in this connection.

Claims 1, 2, 5 through 11 inclusive, 40 through 44 inclusive, 46, 48, 49, 51 through 54 inclusive, 60, 62, and 66 were rejected under 35 U.S.C. Section 102(b) as assertedly anticipated by, or, in the alternative, under 35 U.S.C. Section 103 as assertedly obvious over, each of the following: a publication by Perron-Simon et al. in C. R. Acad. Sc. Paris, volume 283, pages 33 through 35 (12 July 1976) ("the Perron-Simon et al. publication"); a publication by Mossner and Kemmler-Sack in the Journal of the Less-Common Metals, volume 105, pages 165 through 168 (1985) ("the Mossner and Kemmler-Sack publication"), a publication by Chincholkar and Vyawahare in Thermal Analysis 6th, volume 2, pages 251 through 256 (1980) ("the Chincholkar and Vyawahare publication"); a publication by Ahmad and Sanyal in Spectroscopy Letters, Volume 9, pages 39 through 55 (1976) ("the Ahmad and Sanyal publication"); a publication by Blasse and Corsmit in the Journal of Solid State Chemistry, volume 6, pages 513 through 518 (1973) ("the Blasse and Corsmit publication"); United States patent No. 3,472,779 to Kurihara et al. ("the Kurihara et al. '779 patent"); and a publication by Anderton and Sale in Powder Metallurgy No. 1, pages 14 through 21 (1979) ("the Anderton and Sale publication"). It was asserted that the Perron-Simon publication disclosed the composition $\text{Ba}_2\text{La}(\text{Nb}_{13/3})\text{O}_{15}$. It was asserted that the Mossner and Kemmler-Sack publication

disclosed the composition $\text{Ba}_6\text{YNb}_{4.5}\text{O}_{18}$. The Chincholkar and Vyawahare publication assertedly disclosed the composition $\text{Ba}(\text{In}_{0.5}\text{B}_{0.5})\text{O}_3$. It was asserted that the Ahmad and Sanyal publication disclosed Ba_2YNbO_6 on page 43. It was asserted that the Blasse and Corsmit publication disclosed the composition $\text{Ba}_2\text{GdNbO}_6$. The Kurihara et al. '779 patent assertedly disclosed the composition $\text{Ba}(\text{YNb})_{0.5}\text{O}_3$. The Anderton and Sale publication assertedly disclosed the composition $\text{La}_{0.5}\text{Sr}_{0.5}\text{CoO}_3$. Although it was conceded in the Office Action that none of the references cited in this paragraph discussed superconductivity, it was asserted that each appeared to fall within the scope of the claims. It was asserted that a 1987 publication by Ogushi et al. in the Journal of Low Temperature Physics, volume 69, pages 451 through 457 (1987) ("the Ogushi et al. publication") disclosed that La-Sr-Nb-O systems were superconducting. Reference was made to the case law cited in the previous paragraph.

It was asserted in the outstanding Office Action that in the field of high temperature superconductors, many scientific developments were "available" as preprints prior to publication in a journal. It was further asserted that such a preprint was prior art as a printed publication under 35 U.S.C. Section 102(a) or (b) as of the date it was first distributed. The case 3M v. Ansul 213 USPQ 1024, 1037 was cited in this regard. It was requested that any information of the type noted above which was material to the subject matter presently claimed available prior

to the effective filing date of the present application of which the applicants were aware be promptly made of record.

It was suggested that any evidence to be presented in accordance with 37 C.F.R. 1.131 or 1.132 be submitted before final rejection to be considered timely.

C. Summary of the Present Amendments

Claim 1 has been amended to delete the term "near" from the expression "near rare earth-like element." The expression "rare earth-like element" conforms to the expression used in claim 2 as originally filed.

Claim 32 has been amended to correct a minor typographical or other clerical error. Specifically, the term -- composition -- has been substituted for the term "composite."

Reconsideration of the present application as amended and in the light of the comments below is respectfully requested.

D. The Restriction Requirement Under 35 U.S.C. Section 121

The applicants by their attorneys hereby affirm the previous provisional election to prosecute the invention of the claims denominated Group I in the Office Action of 8 August 1990

- specifically, claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive.

The requirement for restriction is respectfully traversed. It is submitted that the claims of Groups I, II and III are directed to inventions which are not "distinct" as that term is used for purposes of 35 U.S.C. Section 121, as explained below.

Turning first to the relationship between the subject matter of the claims of Group I and the claims of Group II, it is noted that - in contrast to the assertion in the Office Action - Group II is not limited to claims directed to a process of making. In addition to claims directed to a process of making a composition of the type which is the subject of claims of Group I, Group II includes claims directed to a method for using such a composition. See, for example, claims 24 through 26 inclusive and claims 86 through 90 inclusive. Furthermore, with regard to the assertion in the outstanding Office Action that the product as claimed in Group I could be made by a process such as sputtering, which is characterized as being materially different from the method for making claimed in Group II, it is submitted that such a sputtering process could well fall within the scope of one or more claims of Group II. See claim 75 in this regard, for example. For the reasons set forth above, it is submitted that the

inventions of the claims of Groups I and II are not distinct for restriction purposes. It is submitted therefore that the requirement of restriction between the claims of Groups I and II was unwarranted and should be withdrawn.

With respect to the relationship of the subject matter of the claims of Groups I and III, it was asserted that the so-called intermediate product of the claims of Group I would be useful as a diamagnetic material used for bulk levitation. However, it is submitted that levitation of superconductive diamagnetic material generally involves generating a magnetic field and immersing the material in the magnetic field. Immersing the superconductive diamagnetic material in such a magnetic field generally causes a supercurrent to be induced in the material which tends to oppose penetration of the magnetic field into the material, giving rise to the levitation effect. It is submitted that such a levitation system involving a diaelectric material of the claims of Group I would meet the limitations of one or more claims of Group II. Consider claim 12, for example. A magnet used to generate the magnetic field for such a levitation system would constitute means for passing a superconducting electrical current through the composition, as called for in claim 12. It is submitted, therefore, that the subject matter of the claims of Group I and III is not distinct for restriction-requirement purposes. It is thus submitted that the requirement for

restriction under 35 U.S.C. Section 121 between the claims of Groups I and III was not justified.

The comments in the preceding paragraphs regarding the subject matter of the claims of Groups II and III also apply with respect to the relationship between the subject matter of the claims of those two Groups. Specifically, it is noted again that not all of the claims of Group II are directed to a process of making, in contrast to the assertion in the outstanding Office Action. Furthermore, it is submitted that use of a process for making material to be employed as a bulk diamagnetic material for levitation would constitute a use which would fall within the scope of at least one of the claims of Group III - in contrast to an assertion in the outstanding Office Action. It is submitted, therefore, that the inventions of the claims of Group II and III are not distinct for restriction-requirement purposes and therefore that the requirement of restriction between the two groups in the Office Action was without justification.

In summary, for the reasons given above it is submitted that the requirement for restriction among the claims of Groups I, II and III in the outstanding Office Action was unwarranted and should be withdrawn.

E. The Rejection Under 35 U.S.C. Section 112, First Paragraph

The rejection under 35 U.S.C. Section 112, first paragraph, involves in one way or another the matter of the scope of the claims to which the present applicants are entitled. The Fisher case was cited in the outstanding Office Action in support of a contention that the applicants were not entitled to claims of the scope of the claims presently under examination. However, it is demonstrated below that if the advance in the art represented by the subject invention and the teachings of the subject application are properly taken into account as provided in the Fisher case, the doctrine of the Fisher case compels the conclusion that the scope of the claims as presently worded is reasonable and fully merited.

The court in the Fisher case analyzed the matter of the scope of patent protection to which an inventor was entitled in the following words:

The issue thus presented is whether an inventor who is the first to achieve a potency of greater than 1.0 for certain types of compositions, which potency was long desired because of its beneficial effect on humans, should be allowed to dominate all such compositions having potencies greater than 1.0, including future compositions having potencies far in excess of those obtainable from his teachings plus ordinary skill.

It is apparent that such an inventor should be allowed to dominate the future patentable inventions of others where those inventions were based in some way on his teachings. Such improvements, while unobvious from his teachings, are still within his contribution, since the improvement was made

possible by his work. It is equally apparent, however, that he must not be permitted to achieve this dominance by claims which are insufficiently supported and hence not in compliance with the first paragraph of 35 U.S.C. 112. That paragraph requires that the scope of the claims must bear a reasonable correlation to the scope of enablement provided by the specification to persons of ordinary skill in the art. In cases involving predictable factors, such as mechanical or electrical elements, a single embodiment provides board enablement in the sense that, once imagined, other embodiments can be made without difficulty and their performance characteristics predicted by resort to known scientific laws. In cases involving unpredictable factors, such as most chemical reactions and physiological activity, the scope of enablement obviously varies inversely with the degree of unpredictability of the factors involved.

Fisher 1009.

According to the court in the Fisher case, "the scope of the claims must bear a reasonable correlation to the scope of enablement provided by the specification to persons of ordinary skill in the art." Thus the standard against which the scope of claims is to be judged is the scope of enablement provided by the specification, not to persons in the abstract, but to persons of ordinary skill in the art. In the instant case, the scope of enablement provided by the specification to persons of ordinary skill in the art can readily be judged by the impact an article describing the invention had on such persons. Specifically, the present invention was disclosed in an article published by the present applicants in the Zeitschrift fur Physik - Condensed Matter in September 1986. The article is incorporated by reference in the specification of the instant application. Scientists throughout the world recognized the importance of the

invention and within only a few months of the publication had found numerous examples of the ceramic-like high temperature superconductors of the type disclosed in the article. Attached to this response as Exhibit A* is a graph of the transition temperatures of the superconductive materials with the highest known transition temperatures versus the date of discovery of the superconductivity of such materials. As may be seen in Exhibit A, the rate of discovery of materials with higher temperatures increased dramatically in a short time after 1986, the date of publication of the Zeitschrift fur Physik article by the present applicants. It is submitted that whatever truth there may be to the generalization that chemical inventions tend to be less predictable than mechanical inventions, in the instant case, the evidence is plain that persons skilled in the relevant arts were able to build on the disclosure of the present invention as set forth in the Zeitschrift fur Physik article extremely productively and extremely rapidly relative to the rate of previous development in the field of superconductivity.

*Exhibit A was taken from a report entitled "High Temperature Superconductivity: Perseverance and Cooperation on the Road to Commercialization" prepared under the auspices of the White House Science Council by the Committee to Advise the President on High Temperature Superconductivity. It should be noted the chairman and the executive secretary of the committee are or had been affiliated with the assignee of the instant application.

It is submitted therefore that under the doctrine of the Fisher case, the applicants are entitled to claims of the scope of the claims as presently worded, given the scope of enablement provided to persons of ordinary skill in this field by the specification of the subject application.

The Court of Customs and Patent Appeals has indicated that unpredictability of the relevant art is not the only factor to be considered in determining the breadth to which claims of a patent application are entitled. Specifically, a patent application is entitled to claims of broader scope to the extent that the application is directed to a pioneer invention. In re Hogan and Banks, 194 USPQ 527,537 (CCPA, 1977). As stated by the Court:

Rejections under [Section] 112, first paragraph, on the ground that the scope of enablement is not commensurate with the scope of the claims, orbit about the more fundamental question: To what scope of protection is this applicant's particular contribution to the art entitled?

Though we do not reach the point on this appeal, we note appellants' argument that their invention is of 'pioneer' status. The records reflects no citation of prior art disclosing a solid polymer of [the relevant monomer], which we may suggest that appellants at least broke new ground in a broad sense. On remand, appellants may be found to have been in fact the first to conceive and reduce to practice 'a solid polymer' as set forth in [the rejected claim on appeal]. As pioneers, if such they be, they would deserve broad claims to the broad concept. What were once referred

to as 'basic inventions' have led to 'basic patents,' which amounted to real incentives, not only to invention and its disclosure, but to its prompt, early disclosure.

Hogan and Banks, page 537. Thus in addition to considering the degree of unpredictability of the art, the advance the claimed invention has made over the prior art must be evaluated in determining the scope to which the claims are entitled.

In the instant case, the advance of the invention was of such a significant and pioneering nature that the inventors were awarded the Nobel Prize for Physics in 1987.

In response to the assertion in the outstanding Office Action that a claim which is so broad as to cover a large number of compositions which do not exhibit the desired properties fails to satisfy the requirements of 35 U.S.C. Section 112, it is noted that each of the composition claims of the subject application includes an express limitation with respect to desired superconductivity properties. Claim 1 of the application, for example, is directed to "a superconductive composition having a transition temperature greater than 26°K." Each of claims 2 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive includes directly or by reference analogous language with respect to superconductive properties.

With a citation to the Corkill case, it was asserted in effect in the outstanding Office Action that reciting a desired result in a claim does not remedy the problem of the claim's covering a large number of compositions which do not exhibit the desired result. The attorneys for the applicants, however, respectfully submit that the Corkill case does not support this proposition. In the Corkill case, the court affirmed a rejection under 35 U.S.C. Section 112, second paragraph, of certain claims in a continuation application under review which were drawn to a detergent composition. According to declarations submitted on behalf of the applicants, the rejected claims read on certain detergent compositions which led to "unacceptable deposition on clothing and washing machine surfaces." The specific claims in question were not set out in the decision in the Corkill case. However, a representative claim of a parent application of the continuation application made no mention of the desired result of avoiding deposition on clothing and washing machine surfaces. On page 1008, right hand column, last full sentence, the court stated that the only difference between the claims of the parent application and the continuation application was an upper limit on the size of certain particles in the detergent composition. In any event, the court made no reference to any recitation of a desired result in the rejected claims of the continuation application, nor did it state that such a recitation would be futile. It would appear therefore that the Corkill case does not support the proposition that recitation of a desired result

somehow does not serve to exclude compositions which do not achieve the recited desired result.

In the instant case, the property of superconductivity is a physically measurable property of the composition being claimed. That the property is also useful and hence desirable should not exclude the property from serving to define the claimed composition. It is submitted that the recitations in the composition claims under rejection regarding superconductive properties serve to exclude compositions which do not have the required superconductive properties.

For the reasons given above, it is submitted that claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive are fully supported by an enabling disclosure and that the scope of such claims is reasonably correlated with the scope of enablement provided by the specification to those of ordinary skill in the art and is merited by the revolutionary advance in the art represented by the invention of the claims. It is submitted therefore that the rejection of claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive under 35 U.S.C. Section 112, first paragraph, was unjustified and should be withdrawn.

G. The Rejections Under 35 USC Section 112, Second Paragraph

The comments in the outstanding Office Action in connection with the rejection under 35 U.S.C. Section 112, Second Paragraph, will be considered in turn.

Although it is submitted that the term expression "near rare earth-like element" questioned in the outstanding Office Action is completely clear and would be understood by a person of even only ordinary skill in the art, claim 1 has been amended to delete the term "near" from the expression. The terminology in claim 1 as amended and claim 2 is consistent. The expression "rare earth-like element" is discussed, for example, on page 7, lines 8 through 12 in the application as originally filed.

With regard to the comment in the Office Action relating to the recitation of a stoichiometric limitation in the composition claims, the attorneys for the applicants point out that each of the claims in question includes a language specifying that the composition be superconductive with a transition temperature of greater than 26° K, or generally analogous language. The properties of superconductivity and the transition temperature are physical properties of a material which can be measured as certainly as the chemical composition of the material can be measured. It is submitted that a claim directed to composition defined in part by superconductivity properties is not

indefinite. The metes and bounds of the invention are defined with the particularity and distinctness required by the second paragraph of 35 U.S.C. Section 112 in each of the composition claims of the present invention.

With respect to the recitation of doping in claim 11, the specification provides a discussion of such doping on page 17, line 12 through page 19, line 12. Moreover, claim 11 depends upon claim 1 and thus incorporates the limitations of claim 1 by reference. It is submitted that claim 11, as presently worded, would be completely clear and definite to one of ordinary skill in the art, particularly in light of the discussion in the specification and in view of the limitations of claim 1 incorporated by reference.

Claim 31 of the present application is a dependent claim which depends upon independent claim 27. Claim 31 states that the claimed composition "has a crystalline structure which enhances electron-phonon interactions to produce superconductivity at a temperature in excess of 26°K." Electron-phonon interactions favorable to the occurrence of superconductivity at higher critical temperatures is discussed in the specification, for example, on page 15, line 20 through page 14, line 9. It is submitted that claim 31 incorporating the limitations of claim 27 upon which it depends and when read in the light of the specification is completely clear and definite.

Claim 32 has been amended to delete the term "composite" questioned in the outstanding Office Action. As amended, claim 32 refers to a composition for which there is an antecedent basis.

The term "oxygen excess" referred to in claim 62 refers to an excess of the oxygen content over a stoichiometric amount. See, for example, the discussion on page 27, line 13 through page 28, line 5 of the application as filed. It is submitted that the reference to oxygen excess would be understood by one of ordinary skill in the art and that claim 62 as presently worded is clear and definite.

The term "transition temperature" questioned in the outstanding Office Action refers to the transition in superconductive materials between a resistive state and the superconducting state. As used in the present application, the term is consistent with conventional usage. The transition temperature does not conventionally refer to the low temperature end of the transition, i.e. the temperature at which zero resistivity is achieved, but rather conventionally refers to a point in the transition from a resistive state to the superconducting state.

With respect to selection of "at least four elements" recited in claim 40, reference is made to the specification of the application which provides examples of superconductive

compositions comprising at least four elements. See, for example, page 12, lines 4 through 19 of the application. Claim 40 does not state or imply that any four elements in the periodic table in any stoichiometric ratio will result in a superconductor which exhibits a superconducting onset at a temperature in excess of 26° K. Claim 40 is directed to a superconductor which exhibits a superconducting onset at a temperature in excess of 26° K which is comprised of at least four elements, none of which itself is superconducting. That such superconductors exist was discovered by the present applicants and constitutes an invention which, it is submitted, they are entitled to claim.

For the reasons set forth above, it is submitted that the claims of the present application, as amended, meet the standards of 35 U.S.C. Section 112, second paragraph. The rejection of claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive under 35 U.S.C. Section 112, second paragraph, was without foundation and should be withdrawn.

H. The Rejections Under 35 U.S.C. Section 102(b)

It was conceded in the outstanding Office Action that none of the eleven references cited against the claims under examination discussed superconductivity. None of the references disclosed or in any way suggested that any composition disclosed

in the reference was superconductive at any temperature, let alone that the composition had a superconductive transition temperature of 26°K or greater.

The position taken in the Office Action was that even if a cited reference did not disclose or suggest that a composition disclosed in the reference was superconductive, the burden was upon the applicants to establish that the composition was not within the scope of the claims.

It is the position of the attorneys for the applicants that the comments in the outstanding Office Action do not so much as make out a prima facie case that any of the specific compositions disclosed in the cited references falls within the scope of any of the claims of the subject application. Absent some showing that one of the specific compositions disclosed in one of the eleven references is a material which is superconductive with a transition temperature of 26°K or greater, no prima facie case has been made that the composition anticipates or renders obvious the subject matter of a claim of the subject application.

Four of the references cited in the outstanding Office Action disclosed materials in terms of compositions which could vary over specified ranges. Specifically, the Shaplygin et al. publication, the Nguyen et al. publication, the 1984 Michel and Raveau publication and the 1985 Michel et al. publication each

disclosed certain compositions in which it was specified that one or more of the elements of the compensation could vary over a certain range.

9 However, under United States patent law, the applicants are fully entitled under 35 U.S.C. Section 102 to claim compositions which might happen to overlap a portion of the concentration ranges broadly recited in the Shaplygin et al., Nguyen et al, Michel and Raveau and Michel et al. publications, because they have discovered that the subject matter claimed has remarkable high-temperature superconductive properties totally unexpected in view of the publications.

The broad statement of a concentration range in the prior art does not necessarily preclude later invention within the concentration range. Whether or not a material subsequently discovered falling within the concentration range is patentable depends upon what the prior art teaches people skilled in the art about the properties of substances falling within that range; if the properties of the newly discovered material are unobvious in view of what the prior art teaches, it may be patentable. In re Waymouth and Koury, 182 USPQ (CCPA 1974). Thus "ranges which overlap or lie inside ranges disclosed by the prior art may be patentable if the applicant can show criticality in the claimed range by evidence of unexpected results." In re Wertheim 191 USPQ 90, 100 (CCPA 1976).

A case decided by the Court of Customs and Patent Appeals, In re Waymouth and Koury, 182 USPQ 290 (CCPA 1974), provides an example of a critical difference which supported patentability of subject matter falling within a range broadly disclosed in a prior-art patent.

The claims at issue in the Waymouth case related to high-pressure electric discharge lamps of a type used for outdoor lighting. The lamps included an arc tube which contains mercury and halogen atoms. Conventional high pressure electric discharge lamps emitted a bluish light, which was a drawback. The appellants found that maximum white light emissions could be achieved when the ratio of halogen atoms to mercury atoms was restricted to certain values. The claims at issue recited a range for the ratio of from about 0.08 to 0.75. Reference to Fig. 2 of the Waymouth and Koury application, which was reproduced in the opinion of the court, will show that the recited range for the ratio of halogen atoms to mercury atoms limited the intensity of white light emission to no less than approximately 0.5 of its highest value.

The claims on appeal had been rejected as unpatentable over an issued United States patent to Reiling. According to the court,

The Reiling patent discloses a device similar to that of appellants' and also seeks to produce white light. The Reiling device incorporates the halogen and mercury atoms used by appellants; however, the claimed ratio is not specifically disclosed in the reference. Appellants have calculated the ratios of halogen to mercury atoms inherently disclosed by

Reiling, which ratios span the range from 0.0000001 to 1.3. These ratios have not been contradicted by the board of solicitor.

Observe that over fifty percent of the range inherently disclosed by Reiling was claimed by the appellants.

In spite of the overlap between the claimed range and the range inherently disclosed in the Reiling patent, the court found that the claims were patentable over Reiling. The court based its decision in part on a finding that the claimed range of ratios was critical for the attainment of maximum white light emission. In the words of the court:

Although Reiling's range of possible ratios envelops the range claimed by appellants, we believe that the appellants' graph in Figure 2 demonstrates the necessary unexpected results. Those results follow from the selection of appellants' critical range, which is narrower than the extremely broad inherently disclosed range of Reiling. We cannot agree with the board's holding that since appellants' lamp is also operable over other ranges of the halogen atom to mercury atom ratio, Figure 2 does not demonstrate an unexpected result. In order to show an unexpected result, we do not believe that the lamp must be inoperable over other ranges, but rather that over the claimed critical range there be a difference in kind, rather than a degree. We believe that Figure 2 demonstrates such a marked improvement, over the results achieved under other ratios, as to be classified as a difference in kind, rather than one of degree. [Citations omitted.]

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The discussion concerning criticality in the Waymouth case applies directly to the question of the criticality of the difference between the subject matter of the claims under discussion in the present application and the disclosures of the

Shaplygin et al., Nguyen et al., Michel and Raveau and Michel et al. publications. It is submitted, therefore, that the reasoning of the court in the Waymouth case compels a finding that the present invention represents a critical, and hence patentable, advance over the disclosures of the four publications.

A second case, In re Duva, 156 USPQ 90 (CCPA, 1967), like the Waymouth case, compels a finding that the claims under discussion are patentable over the Shaplygin et al., Nguyen et al., Michel and Raveau and Michel et al. publications. In the following discussion, the page, column, and line numbers refer to the opinion in the Duva case as reported in 156 USPQ.

The invention in the Duva case concerned a process for the "electroless" deposition of gold on a metal article immersed in a chemical solution. Since gold was deposited by direct chemical action, the process did not require electrodes or a source of electric current as did conventional electroplating processes. The two claims specifically analyzed by the court were directed to "a process for depositing gold on a workpiece" and to the chemical solution used in the process. The two claims had been rejected under 35 U.S.C. Section 103 as unpatentable over a reference which disclosed a process for the electrodeposition of a gold-palladium alloy and an electroplating bath for use in the process. The claim directed to the solution is reproduced below with paragraphing and lettering added for convenience.

1. As a composition for chemically depositing gold and aqueous solution consisting essentially of:

- (a) 0.5-30 g/l of a soluble gold cyanide,
- (b) 0.01 to 30 g/l of a soluble palladous salt,
- (c) absent sufficient CN ions to prevent deposition induced by said palladous salt, and
- (d) sufficient alkali to provide a pH of 8-11.

It is clear from the opinion in the Duva case that the concentration ranges to which the claims on appeal were directed overlapped to concentrations of the prior-art electroplating bath. The court pointed out that the examiner had noted that the proportions of gold cyanide and palladium salt in the claims "overlapped" those of the prior-art electroplating bath. Page 92, column 2, lines 25-28. In addition, the claims called for "sufficient alkali to provide a pH of 8-11," which overlapped with a teaching in the prior-art reference that the electroplating bath preferably have a pH of between 10 and 10.5. Page 92, column 2, lines 16-19. Finally, there was an overlap between the concentration range of cyanide ions called for in the claims and the concentration range of cyanide ions disclosed in the prior-art reference. The reference disclosed a single specific example of an electroplating bath. Page 92, column 2, footnote 6. In addition to the compound gold cyanide, the bath included four base-metal cyanide compounds in specified proportions. The reference further stated that the concentrations of the example could be increased up to three times the quantities recited. However, the patent also stated that the base-metal cyanide compounds were optional and that one or more base metals could be omitted. Page 93, column 1, lines 7-16. Were all four of the

base-metal cyanide compounds to be omitted from the electroplating bath, for example, the cyanide-ion concentration of the resulting bath would overlap the concentrations specified in the claims at issue. In part for this reason the Board of Appeals stated that it did not accord patentable distinction to the limitations in the claims relating to cyanide content and upheld the rejection. Page 93, column 1, lines 20-23.

The Court of Customs and Patent Appeals reversed the decision of the Board of Appeals in spite of the overlap of concentrations. Concerning the cyanide-ion concentration, the court held:

The prior art reference evinces no criticality about the concentration of the cyanide ions whereas appellant's invention depends upon using 'a soluble palladous salt, absent sufficient CN ions to prevent deposition induced' by the palladous salt.

Appellant asserts there is a critical aspect to his invention concerning the concentration of cyanide ions in the bath composition. The solicitor, however, urges that the amount of potassium cyanide used in the prior art reference satisfied the 'broad language' of the claims before the court. We do not agree with this position. When fairly considered for what it teaches one of ordinary skill in the art, the prior art patent does not make obvious the cyanide limitations present in the appealed claims.

Page 94, column 2, lines 17-37. Thus, by looking at the invention as a whole, the court recognized a patentable distinction with respect to the cyanide-ion limitations in the claims at issue, even though these limitations permitted an overlap with the cyanide-ion concentration disclosed in the prior art. It is

*We are not taking
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important to recognize that the court reached its decision by comparing the claimed subject matter as a whole with the teachings of the prior-art reference, taken for what it fairly taught people of ordinary skill in the art. The existence of an overlap in concentrations did not preclude such an analysis.

Turning now to the compositions of the claims under examination, it is submitted that the superconductive properties of the compositions of the claims represent a critical distinction over the properties disclosed for the compositions of the Shaplygin et al., Nguyen et al., Michel and Raveau and Michel et al. publications. Consequently, the compositions of the claims are patentable under the doctrine of the Waymouth and Duva cases over the four publications whether or not an overlap might exist between a claimed composition and a range of compositions disclosed in one of the Shaplygin et al., Nguyen et al., Michel and Raveau and Michel et al. publications.

For the reasons set forth above, it is submitted that the subject matter of claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive of the subject application is not anticipated by any of the eleven references cited in the outstanding Office Action. The rejections of the claims just recited under 35 U.S.C. Section 102(b) as unpatentable over the Shaplygin et al. publication, the Nguyen et al. publication, the

Michel and Raveau publication and the Michel et al. publication and the rejections of claims 1, 2, 5 through 11 inclusive, 40 through 44 inclusive, 46, 48, 49, 51 through 54 inclusive, 60, 62 and 66 under 35 U.S.C. Section 102(b) as unpatentable over the Perron-Simon et al. publication, the Mossner and Kemmler-Sack publication, the Chincholkar and Vyawahare publication, the Ahmad and Sanyal publication, the Blasse and Corsmit publication, the Kurihara et al, '779 patent and the Anderton and Sale publication were unjustified and should be withdrawn.

I. The Rejections Under 35 USC Section 103

It was conceded in the outstanding Office Action that none of the prior art references cited in connection with the rejection under 35 U.S.C. Section 103 disclosed superconductivity. It is submitted, therefore, that all of the patents and publications in question are non-analogous art and therefore not relevant to an analysis the subject matter claimed in the present application under 35 U.S.C. Section 103. A two-fold test for determining whether a reference is from a non-analogous art was stated in In re Deminski 230 USPQ 313, 315 (Fed. Cir. 1986). Under the Deminski test, it must first be determined whether or not the reference in question is within the field of the inventor's endeavor. If it is not, then it must be determined whether the reference is reasonably pertinent to the particular problem with which the inventor was involved.

With respect to the eleven references cited against the present claims in the outstanding Office Action, inasmuch as none of the references mentioned superconductivity, none was within the field of the endeavor of the inventors. Moreover, there is nothing to suggest that any of the eleven cited references was in any way pertinent to the problem of searching for a high-T_c superconductor. Specifically, no prior art patent or publication was cited in the outstanding Office Action which would have suggested that any of the materials disclosed in any of the cited references might be superconductive at any temperature, let alone at temperatures in excess of 26°K. Under the Deminski test, therefore, each of the eleven references cited in connection with the rejections under 35 U.S.C. Section 103 represents non-analogous and may not be used to establish obviousness of the claimed invention.

For the reasons set forth above, it is submitted that the composition of claims 1 through 11 inclusive, 27 through 35 inclusive, 40 through 54 inclusive, 60 through 63 inclusive, and 65 through 68 inclusive were neither disclosed nor suggested by the eleven cited references, taken either alone or in any combination. The rejection of the claims under 35 U.S.C. Section 103 as unpatentable over the references was unjustified and should be withdrawn.

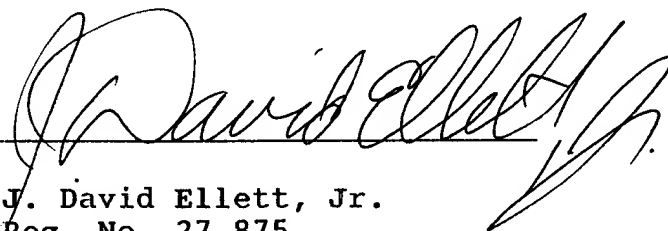


J. Conclusion

It is submitted that the subject matter of the claims of the present application as amended is neither disclosed nor suggested by the art of record considered singly or in any combination and that the claims of the application meet the standards of 35 U.S.C. Section 112, first and second paragraph. Early allowance of the application is therefore earnestly requested.

Respectfully submitted,

Attorneys for the Applicants

by 
J. David Ellett, Jr.
Reg. No. 27,875

IBM Thomas J. Watson Research Center
Intellectual Property Law Department
P.O. Box 218
Yorktown Heights, N.Y. 10598

Telephone No.: (914) 241-4060

8 February 1991



High Temperature Superconductivity: Perseverance and Cooperation on the Road to Commercialization

by

**The Committee to Advise the President
on High Temperature Superconductivity**

(Under the Auspices of The White House Science Council)

The members of the advisory committee are:

R.E. Gomory — Chairman
P. Chaudhari — Executive Secretary
H.K. Bowen
J.S. Foster
T.H. Geballe
M.K. Oshman
J.R. Schrieffer

The advisory committee was ably assisted in organizing, in writing and in scheduling its meetings by Dr. A.H. Nethercot and Ms. Lorraine Miro.

CHAPTERS OF THE REPORT

1. Introduction

Since the remarkable discovery by G. Bednorz and K.A. Müller (in the Swiss laboratory of a U.S. corporation) of superconductivity at temperatures as high as 40K, there has been an explosive growth in the amount of research done and in the number of important new results found in this field. Prior to this discovery, it was generally believed that it was unlikely for the transition to the superconducting state to occur at temperatures much higher than 30K. Today, it is not possible to predict what the ultimate temperature limit to superconductivity may be. The rapid pace of recent developments and the previous history of superconducting transition temperatures stretching over the past seventy-seven years are shown in Fig. 1.

Rarely before have so many disciplines come together in such a short time in so many countries to work on one scientific and technological subject. Physicists, chemists, ceramists and metallurgists, frequently working together, are involved in understanding and controlling the properties of these complex materials. This research is being carried out at industrial, university and government laboratories in the U.S., Europe and Japan. Furthermore, both major recognized groups as well as recently instituted smaller groups with

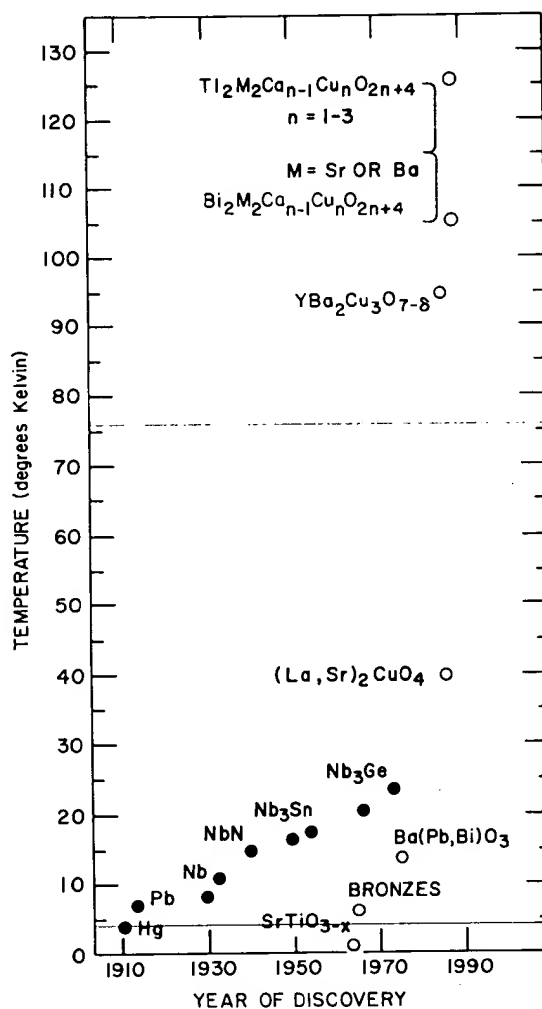


FIG. 1.

ideas and with initiative are playing important roles. An entirely new information network has grown up in this area and operates in parallel with conventional research publication procedures: a very active and organized distribution of pre-publication results is occurring which has greatly hastened the pace of progress.

This worldwide interest in superconductivity is intense. The two most prominent countries in terms of research results are the United States and Japan, but the USSR, France, W. Germany, China, and India also have made significant contributions and even smaller countries such as Portugal and Hungary are publishing results. At a recent international conference held in Europe there were over 800 papers authored by scientists from 39 countries.